Complete Summary

TITLE

Heart failure (HF): 30-day mortality rate.

SOURCE(S)

Specifications manual for national hospital inpatient quality measures, version 3.0b. Centers for Medicare & Medicaid Services (CMS), The Joint Commission; 2009 Oct. various p.

Measure Domain

PRIMARY MEASURE DOMAIN

Outcome

The validity of measures depends on how they are built. By examining the key building blocks of a measure, you can assess its validity for your purpose. For more information, visit the Measure Validity page.

SECONDARY MEASURE DOMAIN

Does not apply to this measure

Brief Abstract

DESCRIPTION

This measure* indicates hospital-specific, risk-standardized, all-cause 30-day mortality (defined as death from any cause 30 days after the index admission date) for patients discharged from the hospital with a principal diagnosis of heart failure (HF).

*This is a Centers for Medicare & Medicaid Services (CMS) only measure.

RATIONALE

Heart failure (HF) is the leading cause of hospitalization among Medicare beneficiaries and is associated with considerable risk of morbidity and mortality. Although heart failure is a progressive illness for which death may be an inevitable consequence rather than a marker of poor quality, clinical experience suggests that the care for these patients is highly variable and studies suggest quality gaps in hospital care, particular in the transition to outpatient care. Moreover, there is

substantial inter-hospital variation in the risk of death at 30 days that is not explained by differences in case mix. Many stakeholders, including patient organizations, are interested in outcomes measures for this common condition that could be used to assess the relative performance of a hospital and provide the opportunity for comparison with other institutions. Risk-standardized mortality rates (RSMRs) can provide important additional information about quality of care that is not currently captured by the process measures and is currently unavailable to hospitals.

PRIMARY CLINICAL COMPONENT

Heart failure (HF); 30-day mortality rate

DENOMINATOR DESCRIPTION

The cohort includes admissions for Medicare fee-for-service beneficiaries age 65 years or older discharged from the hospital with a principal discharge diagnosis of heart failure (HF)* and with a complete claims history for 12 months prior to admission (see the related "Denominator Inclusions/Exclusions" field in the Complete Summary)

The hospital-specific risk-standardized rate is calculated as the ratio of "predicted" to "expected" deaths, multiplied by the national unadjusted rate. The "denominator" of the ratio component is the expected number of deaths for each hospital within 30 days given the hospital's case mix.

*International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, and 428.xx.

Note: Hierarchical logistic regression modeling is used to calculate a hospital-specific risk standardized mortality rate (RSMR). This rate is calculated as the ratio of "predicted" to "expected" deaths, multiplied by the national unadjusted rate. For each hospital, the "numerator" of the ratio component of the RSMR is the predicted number of deaths within 30 days given the hospital's performance with its observed case mix, and the "denominator" is the expected number of deaths given the hospital's case mix. By convention, we use the term "predicted" here to describe the numerator result, which is calculated using the hospital-specific intercept term. We use "expected" for the denominator, which is calculated using the average intercept term. See the 2009 Measures Maintenance Technical Report: Acute Myocardial Infarction, Heart Failure, and Penumonia 30-Day Risk-standardized Mortality Measures for more details.

NUMERATOR DESCRIPTION

The hospital-specific risk-standardized rate is calculated as the ratio of "predicted" to "expected" deaths, multiplied by the national unadjusted rate. The "numerator" of the ratio component is the predicted number of deaths for each hospital within 30 days given the hospital's performance with its observed case mix.

Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, we are using this field to define our statistically-adjusted outcome measure.

Hierarchical logistic regression modeling is used to calculate a hospital-specific risk standardized mortality rate (RSMR). This rate is calculated as the ratio of "predicted" to "expected" deaths, multiplied by the national unadjusted rate. For each hospital, the "numerator" of the ratio component of the RSMR is the predicted number of deaths within 30 days given the hospital's performance with its observed case mix, and the "denominator" is the expected number of deaths given the hospital's case

mix. By convention, we use the term "predicted" here to describe the numerator result, which is calculated using the hospital-specific intercept term. We use "expected" for the denominator, which is calculated using the average intercept term.

More specifically, the expected number of deaths in each hospital is estimated using its patient mix and the average hospital-specific intercept. The predicted number of deaths in each hospital is estimated given the same patient mix but uses an estimated, hospital-specific intercept. The expected number of deaths for each hospital is obtained by regressing the risk factors on the mortality outcome using all hospitals in our sample, applying the subsequent estimated regression coefficients to the patient characteristics observed in the hospital, adding the average of the hospital-specific intercepts, transforming, and then summing over all patients in the hospital to get a value. This is a form of indirect standardization. The predicted hospital outcome is the number of deaths in the "specific" hospital, estimated given its performance and case mix. This is accomplished by estimating a hospital-specific intercept that herein represents baseline mortality risk within the hospital, applying the estimated regression coefficients to the patient characteristics in the hospital, transforming, and then summing over all patients in the hospital to get a value. To assess hospital performance in any reporting period, we re-estimate the model coefficients using the years of data in that period. See the "Description of Allowance for Patient Factors" field in the Complete Summary for risk adjustment details. See the 2009 Measures Maintenance Technical Report: Acute Myocardial Infarction, Heart Failure, and Penumonia 30-Day Risk-standardized Mortality Measures for more details.

Evidence Supporting the Measure

EVIDENCE SUPPORTING THE CRITERION OF QUALITY

- One or more research studies published in a National Library of Medicine (NLM) indexed, peer-reviewed journal

Evidence Supporting Need for the Measure

NEED FOR THE MEASURE

Variation in quality for the performance measured

EVIDENCE SUPPORTING NEED FOR THE MEASURE

Specifications manual for national hospital inpatient quality measures, version 3.0b. Centers for Medicare & Medicaid Services (CMS), The Joint Commission; 2009 Oct. various p.

State of Use of the Measure

STATE OF USE

Current routine use

CURRENT USE

Collaborative inter-organizational quality improvement
External oversight/Medicare
Internal quality improvement
National reporting

Application of Measure in its Current Use

CARE SETTING

Hospitals

PROFESSIONALS RESPONSIBLE FOR HEALTH CARE

Measure is not provider specific

LOWEST LEVEL OF HEALTH CARE DELIVERY ADDRESSED

Single Health Care Delivery Organizations

TARGET POPULATION AGE

Age greater than or equal to 65 years

TARGET POPULATION GENDER

Either male or female

STRATIFICATION BY VULNERABLE POPULATIONS

Unspecified

Characteristics of the Primary Clinical Component

INCIDENCE/PREVALENCE

See the "Burden of Illness" field.

ASSOCIATION WITH VULNERABLE POPULATIONS

Unspecified

BURDEN OF ILLNESS

The prevalence of heart failure (HF) in the United States is high, with 5.2 million Americans currently diagnosed with this condition (Rosamond et al., 2007). HF incidence increases with age and approaches 10 per 1000 population after age 65 (Rosamond et al., 2007). HF is one of the most common causes for hospital admissions among Medicare beneficiaries (Merrill and Elixhauser, 2005) and hospital discharges for HF increased 175% from 1979 to 2004 (Rosamond et al., 2007). A recent study reported that more than 2.5 million Medicare FFS beneficiaries were hospitalized for HF during 2001-2005 and more than 1 in 10 Medicare beneficiaries died within 30 days of hospitalization (Curtis et al., 2008). Thirty-day HF mortality rates vary considerably across hospitals (Rosenthal et al.,

2000) and hospitals that perform well on the Hospital Quality Alliance (HQA) performance measures have lower risk-adjusted mortality rates (Jha et al., 2007).

The high prevalence and considerable morbidity and mortality associated with HF create an economic burden on the healthcare system. In 2005, HF was the fifth most expensive condition treated in US hospitals, accounting for 3.5 % of the national hospital bill. It was also the second most expensive condition billed to Medicare that year, accounting for 5.5% of Medicare's hospital bill (Andrews and Elixhauser, 2007).

Many current hospital interventions are known to decrease the risk of death within 30 days of hospital admission. Current process-based performance measures, however, cannot capture all the ways that care within the hospital might influence outcomes. As a result, many stakeholders, including patient organizations, are interested in outcomes measures that would permit groups of providers to assess their relative outcomes performance for the purpose of internal quality improvement or public reporting.

Mortality of patients with heat failure represents a significant outcome potentially related to quality of care. This rate-based indicator identifies an undesirable outcome of care. High rates warrant investigation into the quality of care provided.

EVIDENCE FOR BURDEN OF ILLNESS

Andrews RM, Elixhauser A. The national hospital bill: growth trends and 2005 update on the most expensive conditions by payer. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2007 Dec. (HCUP statistical brief; no. 42).

Curtis LH, Greiner MA, Hammill BG, Kramer JM, Whellan DJ, Schulman KA, Hernandez AF. Early and long-term outcomes of heart failure in elderly persons, 2001-2005. Arch Intern Med2008 Dec 8;168(22):2481-8. PubMed

Jha AK, Orav EJ, Li Z, Epstein AM. The inverse relationship between mortality rates and performance in the Hospital Quality Alliance measures. Health Aff (Millwood)2007 Jul-Aug;26(4):1104-10. PubMed

Merrill CT, Elixhauser A. Hospitalization in the United States, 2002: HCUP fact book no. 6. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2005.

Rosamond W, Flegal K, Friday G, Furie K, Go A, Greenlund K, Haase N, Ho M, Howard V, Kissela B, Kittner S, Lloyd-Jones D, McDermott M, Meigs J, Moy C, Nichol G, O'donnell CJ, Roger V, Rumsfeld J, Sorlie P, Steinberger J, Thom T, Wasserthiel-Smoller S, Hong Y. Heart Disease and Stroke Statistics--2007 Update. A Report From the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Circulation2007 Feb 6;115(5):e69-171. PubMed

Rosenthal GE, Baker DW, Norris DG, Way LE, Harper DL, Snow RJ. Relationships between in-hospital and 30-day standardized hospital mortality: implications for profiling hospitals. Health Serv Res2000 Mar;34(7):1449-68. PubMed

UTILIZATION

See the "Burden of Illness" field.

COSTS

See the "Burden of Illness" field.

Institute of Medicine National Healthcare Quality Report Categories

IOM CARE NEED

Getting Better

IOM DOMAIN

Safety

Data Collection for the Measure

CASE FINDING

Users of care only

DESCRIPTION OF CASE FINDING

The cohort includes admissions for Medicare fee-for-service beneficiaries age 65 years or older discharged from the hospital with a principal discharge diagnosis of heart failure (HF)* and with a complete claims history for 12 months prior to admission

*International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, and 428.xx.

DENOMINATOR SAMPLING FRAME

Patients associated with provider

DENOMINATOR INCLUSIONS/EXCLUSIONS

Inclusions
The cohort includes admissions for Medicare fee-for-service beneficiaries age 65 years or older discharged from the hospital with a principal discharge diagnosis of heart failure (HF)* and with a complete claims history for 12 months prior to admission. Patients transferred from one acute care facility to another must have

a principal discharge diagnosis of HF at both hospitals. The initial hospital for a transferred patient is designated as the responsible institution for the episode. For patients with multiple hospitalizations for HF during the designated time frame, only one admission is randomly selected for inclusion.

*International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, and 428.xx. Refer to the original measure documentation for a list of all ICD-9-CM codes for HF.

Exclusions

- Admissions for patients who are discharged on the day of admission or the next day and did not die or transfer because it is unlikely they had HF.
- Admissions in which the patient was transferred from another hospital because the death is attributed to the hospital where the patient was initially admitted.
- Admissions for patients with inconsistent or unknown mortality status or other unreliable data (e.g., date of death [DoD] precedes admission date or DoD precedes discharge date of a patient who is discharged alive).
- Admissions for patients enrolled in the Medicare Hospice program any time in the 12 months prior to the index hospitalization including the first day of the index admission since it is likely these patients are continuing to seek comfort measures only, and the goal of these hospitalizations is not survival.
- Admissions for patients who are discharged against medical advice (AMA) because providers did not have the opportunity to deliver full care and prepare the patient for discharge.
- Admissions that were not the first hospitalization in the 30 days prior to a patient's death. This exclusion criterion was applied after one admission per patient per year was randomly selected. It only applies when two randomly selected admissions occur during the transition months (December and January for calendar-year data; June and July for split-year data) and the patient subsequently dies. For example: a patient is admitted on December 18th, 2006 and readmitted on January 2nd, 2007; the patient dies on January 15th, 2007. If both these admissions are randomly selected for inclusion (one for the 2006 calendar year time period and the other for the 2007 calendar year time period), the January 2, 2007 admission will be excluded to avoid assigning the death to two admissions (one in 2006 and one in 2007).

RELATIONSHIP OF DENOMINATOR TO NUMERATOR

All cases in the denominator are equally eligible to appear in the numerator

DENOMINATOR (INDEX) EVENT

Clinical Condition
Institutionalization

DENOMINATOR TIME WINDOW

Time window brackets index event

NUMERATOR INCLUSIONS/EXCLUSIONS

Inclusions
The hospital-specific risk-standardized rate is calculated as the ratio of "predicted" to "expected" deaths, multiplied by the national unadjusted rate. The "numerator" of the ratio component is the predicted number of deaths for each hospital within 30 days given the hospital's performance with its observed case mix.

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Exclusions
Unspecified

MEASURE RESULTS UNDER CONTROL OF HEALTH CARE PROFESSIONALS, ORGANIZATIONS AND/OR POLICYMAKERS

The measure results are somewhat or substantially under the control of the health care professionals, organizations and/or policymakers to whom the measure applies.

NUMERATOR TIME WINDOW

Fixed time period

DATA SOURCE

Administrative data

LEVEL OF DETERMINATION OF QUALITY

Not Individual Case

OUTCOME TYPE

Clinical Outcome

PRE-EXISTING INSTRUMENT USED

Unspecified

Computation of the Measure

SCORING

Rate

INTERPRETATION OF SCORE

Better quality is associated with a lower score

ALLOWANCE FOR PATIENT FACTORS

Risk adjustment devised specifically for this measure/condition

DESCRIPTION OF ALLOWANCE FOR PATIENT FACTORS

Our approach to risk adjustment is tailored to and appropriate for a publicly reported outcome measure, as articulated in the American Heart Association (AHA) Scientific Statement, "Standards for Statistical Models Used for Public Reporting of Health Outcomes" (Krumholz et al., 2006).

We developed a hierarchical logistic regression model to estimate the log-odds of mortality within 30 days of a heart failure (HF) index admission as a function of patient demographic and clinical characteristics. The model includes a random hospital-specific intercept to account for within-hospital correlation of the observed outcomes. This assumes that underlying differences in quality among the hospitals being evaluated lead to systematic differences in outcomes.

Candidate and Final Variables: Candidate variables were patient-level risk-adjustors that are expected to be predictive of mortality, based on empirical analysis, prior literature, and clinical judgment, including demographic factors (age, sex) and indicators of comorbidity and disease severity.

The final set of risk-adjustment variables included:

Demographic	• Age-65 (years above 65, continuous) • Male
Cardiovascular	• History of percutaneous transluminal coronary angioplasty (PTCA) • History of coronary artery bypass grafting (CABG)

	• Congestive heart failure • History of acute myocardial infarction (AMI) • Unstable angina • Chronic atherosclerosis • Cardio-respiratory failure and shock • Valvular and rheumatic heart disease
Comorbidity	• Hypertension • Stroke • Renal failure • Chronic obstructive pulmonary disease (COPD) • Pneumonia • Diabetes and diabetes mellitus (DM) complications • Protein-calorie malnutrition • Dementia and senility • Hemiplegia, paraplegia, paralysis, functional disability • Peripheral vascular disease • Metastatic cancer and acute leukemia and other severe cancers • Trauma in the last year • Major psychiatric disorders • Chronic liver disease

Full details of the development of the risk-standardization model for this measure are available at www.qualitynet.org.

STANDARD OF COMPARISON

External comparison at a point in time
External comparison of time trends
Internal time comparison

Evaluation of Measure Properties

EXTENT OF MEASURE TESTING

To evaluate the performance of the model used for 2009 reporting, we fit the revised model to three single, calendar-year datasets (2005, 2006, and 2007) and to the combined three-year 2005-2007 calendar year dataset. We re-estimated the model variable coefficients, examined their trends across time periods, and examined the model performance in each of these datasets. We also examined trends in the frequency of patient risk factors.

We assessed hierarchial generalized linear model (HGLM) performance in terms of discriminant ability and overall fit for each of the single-year datasets (2005, 2006, and 2007) and for the combined 2005-2007 calendar year dataset. We computed two summary statistics for assessing model performance: the adjusted R2, which indicates the percentage of the patient-level variation in the outcome explained by the model variables, and the area under the receiver operating characteristic (ROC) curve (c-statistic), which is an indicator of the model's

discriminant ability or ability to correctly classify those who die and do not die within 30 days (values range from 0.5 meaning no better than chance to 1.0 meaning perfect discrimination). The adjusted R2 was 0.08-0.09 across the study period and the area under the ROC curve (c-statistic) remained constant at 0.69. For the model using the combined 2005-2007 calendar year dataset, the observed mortality rate was 10.9% (SD 1.6) with a range of 6.3-18.0%.

EVIDENCE FOR RELIABILITY/VALIDITY TESTING

Grosso LM, Schreiner GC, Wang Y, Grady JN, Wang Y, Duffy CO, Turkmani D, Desai MM, Lin Z, Gao J, Normand SL, Drye EE, Krumholz HM. 2009 Measures maintenance technical report: acute myocardial infarction, heart failure, and pneumonia 30-day risk-standardized mortality measures. Baltimore (MD): Centers for Medicare & Medicaid Services; 2009 Apr 7. 47 p.

Identifying Information

ORIGINAL TITLE

MORT-30-HF: heart failure (HF) 30-day mortality rate.

MEASURE COLLECTION

National Hospital Inpatient Quality Measures

MEASURE SET NAME

CMS Mortality Measures

SUBMITTER

Centers for Medicare & Medicaid Services
Joint Commission, The

DEVELOPER

Centers for Medicare & Medicaid Services/The Joint Commission
Yale-New Haven Health Systems Corporation/Center for Outcomes Research and Evaluation under contract to Centers for Medicare & Medicaid Services

FUNDING SOURCE(S)

Centers for Medicare & Medicaid Services (CMS)

COMPOSITION OF THE GROUP THAT DEVELOPED THE MEASURE

This measure was developed by a team of clinical and statistical experts from Yale University/Yale-New Haven Hospital Center for Outcomes Research and Evaluation (Yale-CORE) and Harvard University, through a Centers for Medicare & Medicaid Services (CMS) contract with the Colorado Foundation for Medical Care (CFMC).

FINANCIAL DISCLOSURES/OTHER POTENTIAL CONFLICTS OF INTEREST

Unspecified

ENDORSER

National Quality Forum

INCLUDED IN

Hospital Compare
Hospital Quality Alliance

ADAPTATION

Measure was not adapted from another source.

RELEASE DATE

2007 Apr

REVISION DATE

2009 Oct

MEASURE STATUS

This is the current release of the measure.

SOURCE(S)

Specifications manual for national hospital inpatient quality measures, version 3.0b. Centers for Medicare & Medicaid Services (CMS), The Joint Commission; 2009 Oct. various p.

MEASURE AVAILABILITY

The individual measure, "MORT-30-HF: Heart Failure (HF) 30-day Mortality Rate," is published in "Specifications Manual for National Hospital Inpatient Quality Measures." This document is available from The Joint Commission Web site. Information is also available from the QualityNet Web site and the Hospital Compare Web site. Check The Joint Commission Web site and QualityNet Web site regularly for the most recent version of the specifications manual and for the applicable dates of discharge.

NQMC STATUS

This NQMC summary was completed by ECRI Institute on June 23, 2009. The information was verified by the measure developer on December 29, 2009.

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